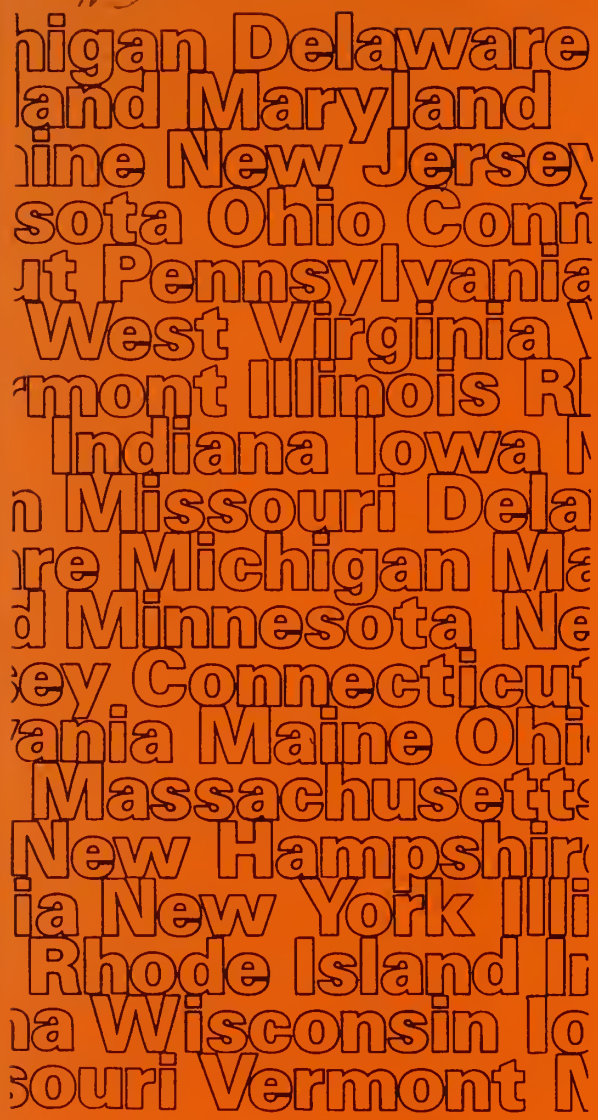

state & private forestry:
- a cooperative effort

An Analysis Of The New England Pilot Fuelwood Project

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AN ANALYSIS OF THE

NEW ENGLAND PILOT FUELWOOD PROJECT

REVISED

DECEMBER 1980

by

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USDA - FOREST SERVICE
NA S&PF

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PREFACE

New England homeowntrs, who have depended on imported oil for as much as 70 percent of their home heating fuel, are turning to wood as the price of oil continues to rise sharply.

The increase in fuelwood use has given rise to concerns about the potential for destructive exploitation of New England's forest resources. Woodlots, especially those with ready access, could be damaged severely without technical assistance by trained foresters in the selection of trees to be cut for fuelwood.

In response to these concerns, the U.S. Department of Agriculture approved a pilot fuelwood/forest management program in New England. Financed by the Agricultural Conservation Program (ACP), the program has become known as the New England Pilot Fuelwood Project. It has been run on a limited trial basis through the Agricultural Stabilization and Conservation Service (ASCS) state and county office system with technical assistance from the Forest Service and the state forestry and extension system.

The Fuelwood Project has been in operation for more than a year and has been well received in New England. Foresters are excited about the new opportunity to thin overstocked hardwood stands while landowners are pleased to be able to improve their stands and obtain firewood at no significant cost.

This program has proved to be very cost effective in achieving the pilot project goals of producing increased supplies of firewood through sound forest management. Expanded economic and employment opportunities also have been provided as a result of this effort. New consulting foresters are getting established by working with enthusiastic landowners. Firewood vendors are becoming more numerous and aid landowners in marketing the wood. And landowners are happy to get firewood for themselves, their friends, and the community as they improve their forest land.

This evaluation was requested by the Forest Service and the Agricultural Stabilization and Conservation Service to determine how effectively the program has achieved the desired silvicultural objectives.

INTRODUCTION

The ACP New England Pilot Fuelwood Project was launched in April 1979 as a four-state, 12-county pilot program to provide technical assistance to landowners wishing to harvest firewood. Besides the developing of management plans and the marking of trees for firewood thinning, the program has provided direct cost share money to be made available for the construction of access roads to otherwise inaccessible qualifying stands of predominantly poletimber hardwoods. In October 1979, Secretary of Agriculture Bob Bergland announced the expansion of the pilot project to include every county wishing to participate in all six New England States. This program is currently available to landowners in more than 50 counties. The pilot was launched in New England because of the region's heavy dependency on imported oil and sharply increasing interest in wood heating with the associated demand for firewood. At last count, approximately 2,200 landowners had requested assistance through this program.

As people turn to wood as an alternative source of home heating fuel, the pressures on the region's forest lands intensify. This growing demand for firewood causes concerns among many people over the future of our hardwood forests. These concerns include the continued future supplies of quality hardwood timber, overcutting of individual timber stands, potential environmental degradation, and the loss of future forest management alternatives because of actions taken now.

To alleviate these concerns, the following program objectives were established:

1. Promote timber stand improvement and silvicultural treatment of the better forested sites, especially as an alternative to arbitrary or concentrated overcutting.

2. Encourage the cutting of firewood in stands that are overstocked and in need of thinning and, in turn, promote more vigorous growth and improve the quality of the residual stands.

3. Reduce the pressures placed on a limited public forest by increasing the private non-industrial area available for firewood harvest.

4. Minimize the potential environmental impacts of unguided cutting, such as increased soil erosion and wildlife habitat destruction.

The professionally supervised harvest of firewood provided by this program appears to be an excellent way of achieving these objectives at minimum cost, while significantly adding to the New England firewood supply.

Program Guidelines

Two practices are included in this project, forest management access roads and forest tree stand improvement, including fuelwood utilization. Eligibility for participation in the program is based on: 1) ownership of 10 acres or more of forest land capable of growing 50 cubic feet of wood per acre per year, 2) minimum treatment area of 5 acres in size, 3) hardwood stands in need of treatment, 4) no more than 30 percent of the cubic foot volume to be removed

can be merchantable products other than firewood, such as pulp or saw logs, and 5) stocking must be such that the removal of a minimum of 5 cords per acre leaves an adequately stocked residual stand. Where landowners agree to manage and harvest as specified in a 10-year forest land management plan, specially designated ACP funds may be used to provide up to 100 percent of the technical assistance cost for the management planning, access road layout, and marking trees for removal. The technical assistance may be provided by the service forester for all of these activities or a private consulting forester for management planning and marking. Consultant foresters are paid with ACP Fuelwood Project cost-share funds on behalf of the landowner. As much as 75 percent of the access road construction cost also is eligible, up to 50¢ per lineal foot. Roads may be constructed only on tracts where access to eligible stands is identified by the service forester as the constraining factor. The cost of erosion controls measures, where needed, are also eligible at the 75 percent cost-share rate, in addition to the cost of road construction.

In early December 1979, several additional provisions were added to the program to eliminate excessive road building. They stipulated that cost-sharing in access road construction could not exceed $25 per acre to be treated under the program. Also added was control over future treatments to areas made accessible by the road, whereby the landowner agrees to do only those practices specified in the management plan or requests a supplement to the plan. These additions are intended to insure that the amount of road construction is appropriate for the treated area's size and that the road will not be used for overcutting or mismanagement of the forest land made accessible.

Program Funding

Special ACP allocations totaling approximately $1,523,000 have been made available to the participating states for cost-sharing. In addition, state ASCS reserves made available $119,000 for the same purpose. Funds totaling $356,200 were allocated to the state forestry organizations through the Forest Service for technical assistance and program administration.

PROGRAM EVALUATION

The program's primary objective is to encourage the thinning of overstocked poletimber hardwood stands for fuelwood in a silviculturally and environmentally beneficial manner. Because it is not yet possible to quantify the environmental benefits, this evaluation will focus on the efficiency with which the silvicultural benefits are achieved.

Program efficiency performance is measured in terms of comparison of the dollar values of the direct silviculturally derived benefits to the attendant direct public and private program related costs. Specifically, performance of the ACP Fuelwood Project is measured through benefit-cost analysis. Simply stated, the resultant benefit-cost ratio (B/C) defines the dollar value of benefits generated per dollar of public and private expenditure. For example, a benefit-cost ratio of 1.5:1 would indicate that the program provides $1.50 in benefits for every dollar of cost. Obviously then, there would be a gain from a project which yielded a benefit-cost ratio greater than 1:1 and a loss from a project with a ratio less than 1:1.

Benefits and Costs

All direct costs and benefits have been developed on an average per acre basis. Data used in the development of costs included actual case summaries for participating landowners, the September 7, 1980, Fuelwood Project Progress Report and actual financial allocation records for the participating states. (See Appendix 1)

The silvicultural benefits are derived from simulated forest management regimes which, it is believed, accurately represent expected changes in yields resulting from treatment of woodlots under the program. These simulations are based on the most current Forest Service research available for the forest types appropriate to the tracts treated in the program area, northern hardwood and upland oaks.

Cost assumptions: There are three basic direct cost components: 1) technical assistance and program administration provided by or through the state forestry organizations, 2) technical assistance provided by consultant foresters and paid by ASCS with special ACP cost-share funds, and 3) the total cost of road construction, both ACP and landowner share.

Program administration and technical assistance costs must be borne by the actual acreage treated under the program. Two estimates of this cost are presented. (See Appendix 2) The first applies all funds allotted for that purpose to the acres included as of September 7, 1980. The second projects acreage to be included by the end of fiscal year 1980. As the acreage continues to rise, the per acre costs decline because the allocation for the pilot project period is fixed. Therefore, each estimate is overstated because it assumes no growth in participation after September 1980.

Cost shares paid to consultants are based on a fixed per acre rate. Therefore, such costs may be determined by applying obligated dollars to approved acres.

The direct costs of road construction are much more difficult to determine. In this analysis the only acres to which road costs are applied are acres to be treated as reported on case summaries. An average per acre cost of road construction is calculated by dividing reported ACP costs from case summaries by the cost-share rate, usually 75 percent, to determine total cost. This figure is then applied to only those acres reported to be thinned on tracts requiring access road construction. No costs are applied to tracts under the program not requiring roads, to additional acres which might be treated over which the program has no control, or to other uses such as recreation and fire access. Therefore, all costs are being borne by the silvicultural aspects of the program.

Cost development: Program administration and technical assistance costs are developed using the following data.

$356,200 - total allocation to state forestry organizations

18,833.4 - acres to be assisted as of 9/7/80 progress report

20,000 - acres expected to be assisted by end of FY 1980

$356,200 ÷ 18,833.4 ac. = $18.91 per acre as of 9/7/80 report

$356,200 ÷ 20,000 ac. = $17.81 per acre as projected for FY 1980

Technical assistance costs paid to consultants for assistance provided -

$520,923 - obligated as of 9/7/80 report

18,833.4 - acres to be treated

$520,923 ÷ 18,833.4 ac. = $27.66 per acre as of 9/7/80 report (assumed to be the same for remainder of FY 1980)

Road construction costs are based on the actual case summary data gathered for cases assisted prior to May 17, 1980.

$112,996 - total cost share dollars paid for construction and erosion control

1,821 acres - reported acres to be treated on cases involving an access road

$112,996 ÷ 1,821 ac. = $62.05 per acre ACP program cost

$ 62.05 ÷ 0.75 (cost share rate) = $82.73 per acre total cost including landowner share

Thinning practice costs are computed by adding program administration to the cost share technical assistance cost.

$18.91 + 27.66 = $46.57 per acre as of 9/7/80 report

$17.81 + 27.66 = $45.47 per acre as estimated for total FY 1980 assists

When access roads are installed in conjunction with thinning, the following are developed.

$46.57 + 82.73 = $129.30 per acre as of 9/7/80 report

$45.47 + 82.73 = $128.20 per acre as estimated for total FY 1980

With the road cost per acre limitation of $25, imposed in December 1979, road construction costs are reduced by $43.47.

$129.30 - 43.47 = $85.83 per acre as of 9/7/80 progress report

$128.20 - 43.47 = $84.73 per acre as estimated for total FY 1980

Benefit development: The monetary benefits of this pilot project are calculated for the quantifiable silvicultural impacts only. The analysis compares the expected cash returns from the forest management activity initiated through this program with those from a comparable unmanaged stand.

The pilot project treatments are concentrated on two basic forest types, northern hardwoods and upland oaks. To determine the value of the yields obtained from the management of these types, stumpage prices were averaged for the past year in four of the participating states.

Prices of future hardwood sawtimber yields were adjusted based on indices of equilibrium prices published in the 1980 Resource Planning Act Assessment. (See Reference 1) In the managed stand projections, no increase in price is used to account for the expected improvement in quality. Such projections would be difficult to substantiate and to quantify.

The stylized management regimes used are based on the most appropriate and current Forest Service research available for each of the two forest types. (See Reference List) Because of the size class and stocking requirements, the desired average age of stands treated under this program is approximately 40 years in upland oaks and 50 years in northern hardwoods.

The alternative yields used to reduce total benefits from management are from a no-management or let grow alternative. This reduction gives net benefits of the management. Consideration was not given to an unmanaged firewood harvest alternative because this would be counter to the program objectives.

To make the net benefits more realistic, a declining rate of participation has been applied to future silvicultural activities. This attempts to account for changes in land ownership that may result in alterations of ownership objectives. Landowners in the future may be more reluctant to harvest materials other than firewood or, as time goes on, interest in active management may wane. More landowners will participate in the final harvest than intermediate treatments due to the significant payment that could be received from that operation.

Another benefit that has been included for evaluation of acreage treated with access roads is the anticipated future treatment of land made accessible but not included in the program at this time. The acreage from which firewood is harvested through thinning operations is assumed to double during the 10-year practice life of the access road. This means that over the next 10 years a landowner who has installed an access road and participated in this program, will use that access to thin more acres for firewood. The adjustment is an attempt to account for expected firewood thinnings that have not been reported under the program.

For the purposes of this evaluation, three different discount rates have been used to determine present net value of the silvicultural benefits--4 percent, 7 1/8 percent and 10 percent. The first two are in accordance with Forest Service Manual 1971.51 (see Reference 7). Also used was the 10 percent rate based on discussions with Forest Service Washington Office staff about current requests from the Office of Management and Budget (OMB). All future benefits have been discounted to make them comparable to direct costs, which are assumed to be incurred in the first year (see Appendix 2).

Adjusted net values of the benefits are derived by multiplying all discounted values by the participation rate for each operation--primary, intermediate, or final harvest. The adjusted discounted benefits are then totaled over the remainder of the rotation period, 50 years for northern hardwoods and 40 years for upland oaks. The discounted returns of the no management alternative are subtracted from the total returns produced by the management activity and the anticipated rate of participation.

The difference is the present value of the net returns to the forest management regimes attributable to the program. This amount is used as the benefit for the benefit-cost analysis.

Results

Based on data already gathered the most likely benefit-cost ratio for the program under the current program structure is about 1.6:1. (See Table below) Accordingly, for every public and private dollar spent on this program, $1.60 worth of cash returns will be generated from the direct silvicultural effects.

BENEFIT COST RATIOS FOR THE ACP
FUELWOOD PROJECT (10% discount rate)

	TRACTS REQUIRING		
ROAD COSTS	ROADS	NO ROADS	ALL TRACTS
NO LIMIT	0.9	1.7	1.5
$25 LIMIT	1.4	1.7	1.6

In general, the results are quite positive even when the net benefits are discounted at a relatively high rate, 10 percent. In most circumstances the B/C ratios for the program are well above the "break-even" level. The only exception covers the period when some unnecessary road building took place, and the benefit cost ratio dipped to 0.9:1 for tracts requiring access roads. Since then, an administrative decision has been made limiting the ACP cost-share for road construction to a maximum of $25 per acre. Under this revised regulation, the B/C for new roaded tracts is estimated to be 1.4:1.

Although the B/C's are uniformly greater than 1:1, with the exception noted, there are differences related to forest type and to presence or absence of access roads. B/C's and therefore net returns are consistently higher for unroaded and northern hardwood tracts than for roaded and upland oak tracts (See Appendices 3a-c).

The good showing of the program in terms of its B/C's is actually understated because all program costs have been attributed to the silvicultural activity and only benefits from the silvicultural activity have been included. If other benefits, such as those from recreation, wildlife habitat improvement, aesthetic improvement and fuel oil displacement are added, then program performance would have been even better. Similarly, if some of the program costs had been attributed to the non-silvicultural benefits, and therefore removed from the B/C calculation, program performance would have been improved. For example, if only 10 percent of the program costs were attributable to these other types of benefits, then even the lowest B/C ("No limit" - "Tracts requiring roads") would have been 1:1.

Another factor tending to reduce the level of program performance (B/C's) is the rate used to discount future benefits. This discussion is based on the usage of a 10 percent rate. If the 7 1/8 percent or 4 percent rates are used, all aspects of the program have higher B/C's with the lowest equal to or greater than 1:1 (See Appendix 4).

In addition to harvesting firewood and improving the future yields from their woodlots many landowners are interested in other benefits. From 30 to 40 percent are interested in improving wildlife habitat, both food and cover. These objectives are being incorporated into the forest management plan and cutting prescription. Improved recreational opportunities are another desire of 66 percent of the landowners. Where access roads are constructed, these additional opportunities are being realized at an accelerated rate. Many landowners have expressed great satisfaction from using the roads during winter months as cross country ski trails. This is a popular passive alternative use of the new roads during a period of the year when they may otherwise be unused.

An extremely important consideration in the construction of access roads in the rugged terrain is the protection of water quality. The program has provided several provisions to insure this protection. First, trained professionals are laying out the roads to take advantage of topographical features and stay within the limitations of the slopes and soils present. Second, forest contractors and excavators are developing skills through their work with the program, its objectives, and the people involved. As this experience expands, it hopefully will carry forth into other forest related and construction activities.

A significant benefit of this program is that it provides the owner of private forest land an opportunity to become more self-sufficient through relief from increasing oil prices. The landowner can obtain an alternative energy supply from domestic sources which in turn releases that imported oil for use in industry, domestic heating, and power generation to other areas of the country where it is needed. To-date, this project has freed approximately 16.8 million gallons or about 400,000 barrels of #2 fuel oil.

SUMMARY AND CONCLUSIONS

This project has been evaluated to determine whether or not the silvicultural benefits alone can justify the costs which are being incurred. The answer to this is obviously a resounding yes! The total benefits are far greater than those used for the anlaysis. Many of these benefits, although difficult to estimate in monetary terms, could equal those of the timber stand improvement. One example is the long term commitment landowners are developing to good multiple-use forest management. Through the opportunities and efforts generated by this project, many landowners are taking an active interest in what they can do with their forest land. These people are realizing the substantial benefits that they can derive with a little effort.

Under this program, fuelwood is being generated in an economically efficient and silviculturally and environmentally sound manner. In an area where fuelwood harvesting is bound to occur because of high demand, this project offers much. By providing professional assistance to landowners, the program enables the fuelwood to be harvested properly, thereby insuring a future supply of quality hardwoods, while protecting the quality of the environment, and enhancing wildlife habitat, recreational opportunities, and woodlot aesthetics.

RECOMMENDATIONS

Based on this evaluation and the experience gained on this project, it is recommended that the fuelwood program be continued and be considered for expansion to other areas of the country which have a high firewood demand and cutting level. It is recommended also that:

1. Provisions be made to ensure that all service and consultant foresters working on the project receive periodic training. This should include both the silvicultural and access road objectives and implementation guidelines, emphasizing the associated wildlife, recreational, and water quality considerations, as well.

2. Program guidelines be more detailed to ensure that practices are installed properly and economically, and to permit the kind of interagency coordination necessary to make the program effective.

3. Continued monitoring and evaluation of this project be provided to determine what the total benefits are and how the program can be improved.

4. Additional information be gathered to determine the effects program activity has had on firewood supply and prices.

REFERENCES

1. An Assessment of the Forest and Range Land Situation in the United States. 1980. USDA Forest Service Publication, FS-345. 631 pp.

2. Burning Wood by L. D. Baker et al. 1978. Northeast Regional Agricultural Service Publication, NE-191. NRAES, Riley Robb Hall, Cornell University, Ithaca, NY 14853. 30 pp.

3. Even-aged Silviculture For Upland Central Hardwoods by Benjamin A. Roach and Samuel F. Gingerich. 1968. Agriculture Handbook 355. USDA Forest Service, Upper Darby, PA. 39 pp.

4. Guidelines for the New England Pilot Fuelwood Project. 16 pp.

5. Management of Young and Intermediate Stands of Upland Hardwoods by Samuel F. Gingerich. 1971. USDA Forest Service Research Paper NE-195. Northeastern Forest Experiment Station, Upper Darby, PA.

6. A Silvicultural Guide for Northern Hardwoods in the Northeast by William B. Leak, Dale S. Solomon, and Stanley M. Filip. 1969. USDA Forest Service Research Paper NE-143. Northeastern Forest Experiment Station, Broomall, PA 34 pp.

7. Forest Service Manual, Interim Directive No. 7, Chapter: 1970 Economic and Social Analysis, September 2, 1980.

APPENDIX 1

ACP FIREWOOD PRACTICE CASE SUMMARY

Fill in at County ASCS Office

A. Farm Number _____

B. State Name _____

C. County Name _____

D. Date case approved _____

E. Cost-Sharing authorized for:

1. Marking Acres _____

2. Road Building ($) _____

3. Erosion control structures (Value) $ _____

To be filled in by Forester

F. Total Acres in Forest Management Plan _____

G. Forest Type _____

H. Site Class (Cubic ft. potential) _____

I. Practice to be installed _____

1. Thinning Acres _____

2. Cull Tree Removal Acres _____

3. Understory Release Acres _____

4. Fire and Forest Management Access Roads
Lineal Feet _____

5. Erosion Control on Roads
List measures installed _____

6. Acres made accessible by road _____

7. Estimated Firewood Cords to be removed _____

J. Other Forest Resource Considerations	Yes	No
e.g., Den tree protection (check one)	☐	☐
Esthetics (check one)	☐	☐
Wildlife cover enhancement (acres)	_____	
Wildlife food improvement (acres)	_____	
Recreation (acres)	_____	
Water quality enhancement (acres)	_____	

APPENDIX 2

Costs of Pilot Fuelwood Project

Based on 9/7/80 Progress Report Acreages

Item	Year	Value	Present Value
Technical Assist. & Program Administration	0	$18.91	$ 18.91
Technical Assistance (Mgmt. Plan & Marking by Consultants)	0	27.66	27.66
Access road construction (public & private)		(82.73)	(82.73)
		Thin only	$ 46.57
		Thin with access road	$129.30

Based on Total Assists through end of FY 80

Item	Year	Value	Present Value
Technical Assist. & Program Administration	0	$17.81	$ 17.81
Technical Assistance (Mgmt. Plan & Marking by Consultants)	0	27.66	27.66
Access road construction (public & private)	0	82.73	(82.73)
		Thin only	$ 45.47
		Thin with road	$128.20

Based on Total Assists through end of FY 80 and $25/acre c/s limit for roads

Item	Year	Value	Present Value
Technical Assist. & Program Administration	0	$17.81	$ 17.81
Technical Assistance (Mgmt. Plan & Marking by Consultants)	0	27.66	27.66
Access road construction (public & private)	0	39.26	(39.26)
		Thin with road	$ 84.73

CALCULATING NET PRESENT VALUE AND BENEFIT/COST RATIOS USING A 4% DISCOUNT RATE

Northern Hardwoods

Item	Year (Age)	Volume	Value* ($)	Discount Factor at 4%	Present Value ($)	Participation Rate (%)	Adjusted Value ($)
Firewood thinning	0(50)	6.5 cords	65.00	1.000	65.00	100	65.00
Intermediate harvest	20(70)	8 cords 2.5 MBF	241.18	0.45639	110.07	40	44.03
Final harvest	50(100)	20 cords 11 MBF	1,009.27	0.14071	142.01	75	106.51
			Total Value of Management		317.08		215.54
No mgmt. alternative harvest	50(100)	20 cords 7.2 MBF	729.70	0.14071	-102.68	100	-102.40
			Net Value of Mgmt. Alternative		214.40		113.14
Additional firewood thinning with access roads	5(55)	6.5 cords	65.00	0.82193	53.43	100	53.43
			Net Value of Mgmt. with Roads		267.83		166.57

B/C's

Thin only $\frac{113.14}{46.57(9/7/80)} = 2.4:1$ $\frac{113.14}{45.47(9/30/80)} = 2.5:1$

Thin with road $\frac{166.57}{128.20} = 1.3:1$ w/$25/ac. limit $\frac{166.57}{84.73} = 2.0:1$

Upland Oaks

Item	Year (Age)	Volume	Value* ($)	Discount Factor at 4%	Present Value ($)	Participation Rate (%)	Adjusted Value ($)
Firewood thinning	0(40)	6.3 cords	63.00	1.000	63.00	100	63.00
Intermediate harvest	10(50)	4 cords .2 MBF	62.90	0.67556	42.49	50	21.25
Intermediate harvest	20(60)	3.6 cords .28 MBF	64.37	0.45639	29.38	40	11.75
Intermediate harvest	30(70)	3.7 cords .71 MBF	109.63	0.30832	33.80	30	10.14
Final harvest	40(80)	28.8 cords 10.01 MBF	1,375.89	0.20829	286.58	75	214.94
			Total Value of Management		455.25		321.08
No mgmt. alternative harvest	40(80)	35.6 cords 8.2 MBF	1,247.18	0.20829	-259.78	100	-259.78
			Net Value of Mgmt. Alternative		195.47		61.30
Additional firewood thinning with access roads	5(45)	6.3 cords	63.00	0.82193	51.78	100	51.78
			Net Value of Mgmt. with Roads		247.25		113.08

*Based on 1979-80 stumpage prices of $10/cord and northern hardwoods at $70/MBF and Oaks at $110/MBF

B/C's

Thin only $\frac{61.30}{46.57(9/7/80)} = 1.3:1$ $\frac{61.30}{45.47(9/30/80)} = 1.3:1$

Thin with road $\frac{113.08}{128.20} = 0.9:1$ w/$25/ac. limit $\frac{113.08}{84.73} = 1.3:1$

APPENDIX 3b

CALCULATING NET PRESENT VALUE AND BENEFIT/COST RATIOS USING A 7 1/8% DISCOUNT RATE

Northern Hardwoods

Item	Year (Age)	Volume	Value* ($)	Discount Factor at 7 1/8%	Present Value($)	Participation Rate (%)	Adjusted Value($)
Firewood thinning	0(50)	6.5 cords	65.00	1.000	65.00	100	65.00
Intermediate harvest	20(70)	8 cords 2.5 MBF	241.18	0.25245	61.56	40	24.62
Final harvest	50(100)	20 cords 11 MBF	1,009.27	0.03202	32.32	75	24.24
				Total Value of Management	158.88		113.86
No. mgmt. alternative harvest	50(100)	20 cords 7.2 MBF	729.70	0.03202	- 23.36	100	- 23.36
				Net Value of Mgmt. Alternative	135.52		90.50
Additional firewood thinning with access roads	5(55)	6.5 cords	65.00	0.70836	46.07	100	46.07
				Net Value of Mgmt. with Roads	181.59		136.57

B/C's

Thin only $\frac{90.50}{46.57(9/7/80)} = 1.9:1$ $\frac{90.50}{45.47(9/30/80)} = 2.0:1$

Thin with road $\frac{136.57}{128.20} = 1.1:1$ w/$25/ac. limit $\frac{136.57}{84.73} = 1.6:1$

Upland Oaks

Firewood thinning	0(40)	6.3 cords	63.00	1.000	63.00	100	63.00
Intermediate harvest	10(50)	4 cords .2 MBF	62.90	0.50245	31.60	50	15.80
Intermediate harvest	20(60)	3.6 cords .28 MBF	64.37	0.25245	16.25	40	6.50
Intermediate harvest	30(70)	3.7 cords .71 MBF	109.63	0.12685	13.91	30	4.17
Final harvest	40(80)	28.8 cords 10.01 MBF	1,375.89	0.06373	87.69	75	65.77
				Total Value of Management	212.45		155.24
No mgmt. alternative harvest	40(80)	35.6 cords 8.2 MBF	1,247.18	0.06373	- 79.48	100	- 79.48
				Net Value of Mgmt. Alternative	132.97		75.76
Additional firewood thinning with access roads	5(45)	6.3 cords	63.00	0.70836	44.66	100	44.66
				Net Value of Mgmt. with Roads	177.63		120.42

*Based on 1979-80 stumpage prices of $10/cd and Northern Hardwoods at $70/MBF and Oaks at $110/MBF

B/C's

Thin only $\frac{75.76}{46.57(9/7/80)} = 1.6:1$ $\frac{75.76}{45.47(9/30/80)} = 1.7:1$

Thin with road $\frac{120.42}{128.20} = 0.9:1$ w/$25/ac. limit $\frac{120.42}{84.73} = 1.4:1$

APPENDIX 3c

CALCULATING NET PRESENT VALUE AND BENEFIT/COST RATIOS USING A 10% DISCOUNT RATE

Northern Hardwoods

Item	Year (Age)	Volume	Value* ($)	Discount Factor at 10%	Present Value ($)	Participation Rate (%)	Adjusted Value ($)
Firewood thinning	0(50)	6.5 cords	65.00	1.000	65.00	100	65.00
Intermediate harvest	20(70)	8 cords 2.5 MBF	241.18	0.14864	35.85	40	14.34
Final harvest	50(100)	20 cords 11 MBF	1,009.27	0.00852	8.60	75	6.45
			Total Value of Management		109.45		85.79
No mgmt. alternative harvest	50(100)	20 cords 7.2 MBF	729.70	0.00852	- 6.22	100	-6.22
			Net Value of Mgmt. Alternative		103.23		79.57
Additional firewood thinning with access roads	5(55)	6.5 cords	65.00	0.62092	40.36	100	40.36
			Net Value of Mgmt. with Roads		143.59		119.93

B/C's — Thin only $\frac{79.57}{46.57(9/7/80)} = 1.7:1$ $\frac{79.57}{45.47(9/30/80)} = 1.8:1$

Thin with road $\frac{119.93}{128.20} = 0.9:1$ w/$25/ac. limit $\frac{119.93}{84.73} = 1.4:1$

Upland Oaks

Item	Year (Age)	Volume	Value* ($)	Discount Factor at 10%	Present Value ($)	Participation Rate (%)	Adjusted Value ($)
Firewood thinning	0(40)	6.3 cords	63.00	1.000	63.00	100	63.00
Intermediate harvest	10(50)	4 cords .2 MBF	62.90	0.38554	24.25	50	12.12
Intermediate harvest	20(60)	3.6 cords .28 MBF	64.37	0.14864	9.57	40	3.83
Intermediate harvest	30(70)	3.7 cords .71 MBF	109.63	0.05731	6.28	30	1.88
Final Harvest	40(80)	28.8 cords 10.01 MBF	1,375.89	0.02209	30.39	75	22.79
			Total Value of Management		133.49		103.62
No mgmt. alternative harvest	40(80)	35.6 cords 8.2 MBF	1,247.18	0.02209	- 27.55	100	- 27.55
			Net Value of Mgmt.. Alternative		105.94		76.07
Additional firewood thinning with access roads	5(45)	6.3 cords	63.00	0.62092	39.12	100	39.12
			Net Value of Mgmt. with Roads		145.06		115.19

*Based on 1979-80 stumpage prices of $10/cord and Northern Hardwoods at $70/MBF and Oaks at $110/MBF

B/C's — Thin only $\frac{76.07}{46.57(9/7/80)} = 1.6:1$ $\frac{76.07}{45.47(9/30/80)} = 1.7:1$

Thin with road $\frac{115.19}{128.20} = 0.9:1$ w/$25/ac. limit $\frac{115.19}{84.73} = 1.4:1$

APPENDIX 4

BENEFIT-COST RATIOS FOR ACP FUELWOOD PROJECT (7 1/8 percent discount rate)*

ROAD COST	TRACTS REQUIRING ROADS	TRACTS REQUIRING NO ROADS	ALL TRACTS
NO LIMIT	1.0	1.9	1.6
$25 LIMIT	1.6	1.9	1.8

BENEFIT-COST RATIOS FOR ACP FUELWOOD PROJECT (4 percent discount rate)*

ROAD COST	TRACTS REQUIRING ROADS	TRACTS REQUIRING NO ROADS	ALL TRACTS
NO LIMIT	1.2	2.1	1.8
$25 LIMIT	1.8	2.1	2.0

*All B/C's are calculated using average administration and technical assistance costs as projected for FY80. Aggregating to program levels is achieved by weighting the B/C's in Appendix 3a-c by acreage for forest type (68 percent northern hardwoods, 32 percent upland oaks) and the need for access roads (67.5 percent need no roads, 32.5 percent need roads).